Truth in Energy
(TiE©)

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Submission

on the

Draft 2023 Integrated Resource Plan

(IRP2023)

to the

Department of Mineral Resources and Energy

(DMRE)

on

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1 Introduction

What follows proposes what can and should be planned within 'real world' constraints. To that end, it suggests (a) ending the outmoded monopoly legacy and mindset as most advanced countries have done, (b) maximising the value of existing resources, (c) minimising the government's burden so that it can provide higher priority benefits, (d) optimising the emerging electricity market, and (e) ensuring secure universal supply to the highest achievable levels of quality and affordability.

Everyone wants excellent, cheap and constant electricity for all. That is neither debatable nor in issue. Since everyone wants the same thing, it should be easy to assume good faith in the search for optimal solutions.

The IRP concept refers back to when there was a statutory monopoly. Eskom was, by law, the only permitted producer and supplier of electricity for over 100 years. That this is no longer the case suggests that the original IRP concept is no longer appropriate. What is appropriate in the new order is addressed below.

The government's extremely tough policy decision is how to improve electricity generation, transmission and supply so as to maximise benefits with extremely limited resources. The degree to which resources is limited has received virtually no attention in the IRP. Hundreds of billions of rands would be required for what is envisaged, yet nothing has been budgeted for the next three years. There is unanimity that the Treasury cannot fund the IRP. The same is true in another context, NHI. IRP and NHI are by far the biggest and highest-cost proposals in South African history, and there is no money for either (in the present or next few Budgets).

The implications and what to do about them are addressed herein. This Submission makes the case for how best to achieve the government's laudable objectives. The challenge is not 'whether, but how'.

The Freedom Foundation, Izwe Lami and Truth in Energy acknowledges with appreciation the hand of goodwill extended by being invited to make this submission.

As with all our work, this is strictly apolitical. We distance ourselves from all politicised debate. The content is independent of all energy and energy policy vested interests.

Under Leon Louw, the old Free Market Foundation (FMF) advocated optimal electricity policies for 50 years. As its founder, leader and last president, he now leads a rejuvenated and modernised Freedom Foundation to promote the FMF's original values more constructively. The new Freedom Foundation (FF) draws and improves on the old FMF's decades of involvement and expertise.

This submission is in three parts.

Part 1 addresses the broad electricity policy framework.

Part 2 addresses technical aspects.

Part 3 addresses climate and economic aspects.

Appendix: Contribution by the South African Nuclear Build Platform (SANBP, NuEnergy).

Part 1

2 Is IRP2023 conceptually flawed?

Much has been written and said about whether there should be an IRP at all. The discourse should be taken seriously.

It is proposed that the answer is not binary. It should not be seen as a contest between two extremes.

The problem faced by the concept of IRPs is that they cannot apply to dynamic markets as envisaged for electricity. An IRP for an electricity market makes no more sense than an IRP for groceries, houses, cars or summer holidays.

Why, it has been asked, have an IRP at all under present changed conditions, when there is no national grocery or vehicle plan, and open markets supply both easily.

Such a plan would be apt for Eskom management, as opposed to the department, even if Eskom were to remain the sole provider of electricity, but it is not apt in the envisaged dynamic market.

It is proposed that IRP2023 should anticipate the new reality of electricity markets. It should not replicate what might have been appropriate when all power was supplied by a single buyers (monopsony) and vendor (monopoly). It should provide for phasing out of the IRP model.

Once we have fully functional electricity markets as should be proposed in IRP2023, the need for IRPs will fall away completely. Each market operator, including ESKOM would have its own non-integrated plan.

It is not necessary to privatise Eskom for there to be a fully efficient market, just as there was no need to privatise Telkom, SAA or SABC. The proven inefficiency of central planning is why IRP2023 should open the energy market to all investors, not just renewables. IRP2023 should include a clear market liberalisation plan. Lifting licensing requirements for producers and ending NERSA control should be part of that plan.

There is an enormous incentive for the government to adopt this policy. It does not, as is clear from the 2024-2025 Budget, have the funds for what is proposed in IRP2023. If power is marketized, the state itself would be freed from the burdens and risks associated with these electricity projects. It would have a larger tax base and more revenue for social programmes.

3 Basic Framework

There are fundamental conceptual policy imperatives that ought to inform all aspects of IRP2023:

4 ESKOM ‘liberation’

South Africa has and will increasingly have electricity markets within which ESKOM is expected to be competitive and efficient. During Eskom’s glory years it was autonomous. Part of what has gone wrong is that it autonomy has been eroded by various changes, such as political interference (falling under three ministries, and Treasury), and NERSA control (especially price control and licensing).

It is proposed that ESKOM should be ‘liberated’ so as to enable it to operate undependably again. IRP2023 should specify that ESKOM will be free, for instance, to set prices (knowing that it will increasingly face competition). The competition it faces increasingly includes other vendors entering the market (as promised in the 1998 White Paper), as well as decentralised production for own consumption (ranging from diesel generators and rooftop panels to large power plants).

The word ‘privatisation’ is bandied about in an uninformed and unhelpful manner. Regardless of the merits of the idea, the fact is that ESKOM will not be privatised now, nor for many years, if ever. What is needed is a clear understanding of what is achievable in the real world, which is for ESKOM to operate independently and freely under continually freer conditions on a ‘level playing field’.

4.1 NERSA’s future

NERSA was created when ESKOM was, with minimal capacity exceptions, a statutory monopoly. NERSA essentially regulated ESKOM. That the country was plunged into a decade and a half of blackouts and loadshedding should be recognised in IRP2023 as substantially or primarily due to the regularity failure of NERSA.

ESKOM faced manifestly absurd realities. It was forced, for instance, by NERSA to sell electricity for less than it was forced by the Department of Mineral Resources and Energy (DMRE) to pay renewable power producers. Eskom was, as the proverbial ‘ham in the sandwich’ was forced to incur huge operating losses.

IRP2023 should provide that NERSA will no longer be a market regulator, and that it should be (or be replaced by) a standards regulator.

4.2 ESKOM is not a charity

Eskom has also been forced by way of ubiquitous political interference to supply electricity as a welfare service. Eskom is not and should not be a charity. This should never have been done, and IRP2023 should provide for it to end.

If the government wants to provide electricity to sub-economic communities at operating losses, it should pay ESKOM market-determined tariffs from a welfare budget.

4.3 Unbundling

There is much debate about ESKOM ‘unbundling’, and the first steps towards it in the form of the ‘ISMO Bill’ have been announced. IRP2023 should make it clear that discourse is inherently flawed.

How ESKOM is structured should not be decided by outsiders, especially not by people who are not extremely well-informed, many of whom currently are expressing strident opinions. Such decisions should be, as in any firm, exclusively management and board decisions or, more appropriately, a series of decisions in response to changing circumstances.

Just as outsiders are and should not be involved in whether Woolworths should unbundle into Woolworths Food or Clothes, or integrate them, and whether Pick ‘n Pay should have ATMs, is a management decision, so whether Eskom unbundles also should be a management decision.

The discourse, from which IRP2023 should be distanced, started more than a decade and a half back with the idea of an ‘IMO’, ‘ISMO’ or ‘ISTMO’.

How ESKOM might structure itself goes further. It might be optimal to stay as is, revert to the autonomy it enjoyed in its glory days, hive-off the grid (as currently proposed), split into three (generation, transmission, distribution), or – which might make the most sense – split into those three operations, but also create nuclear, coal, renewables, intensive users, gas, hydro and the like subsidiaries.

It might make sense to do nothing of the kind, but to unbundle into geographic regions and metropolitan markets instead, IRP2023 should provide for and facilitate locating such questions firmly in the hands of ESKOM’s board and management, and then not as an event, but as an on-going process indefinitely onto the future.

Turning to specific aspects of IRP2023, it is informed by various assumptions. This Submission distinguishes between ‘positive’ and ‘questionable’ assumptions.

5 Positive Assumptions.

5.1 Nuclear

Inclusion of new nuclear power is enlightened, essential and long overdue.

Nuclear is by far the safest, cleanest and greenest power source. With appropriate and less costly (superfluous and supposed) safety regulation, nuclear would also be the cheapest, especially in the long run.

South Africa adheres to international norms, but should make a strong case, in concert with other developing countries, for nuclear safety regulation to be radically and realistically reformed.

IRP2023 should provide for nuclear to be introduced much sooner than envisaged, especially (private or government) small modular reactors (SMRs). International experience shows that South Africa could and should have new nuclear power generation within six years.

The Nuclear Energy Corporation (NECSA) seems ideally positioned to be tasked with responsibility for government-owned SMRs. It is, after all, as is clear from its founding documents, an 'energy' corporation.

IRP2023 should provide for this.

Whether 'big' nuclear should fall under NECSA, a new entity (perhaps with Koeberg), or under Eskom is less obvious. IRP2023 should interrogate the options and make a recommendation. In the absence of good reasons to the contrary, which are not yet 'on the table', the default assumption appears to be to have all nuclear within a single structure, probably NECSA.

5.2 Private Power

The assumption that envisages private sector generation is sound, and probably by far the best way to achieve electricity security with all possible expeditiously.

The current approach, however, is flawed to the extent that it is confined almost entirely in renewables.

It also envisages renewables on the current model where the cost of integration and baseload is shifted to ESKOM. There should be a level playing field in which all electricity must be dispatchable at the supplier's expense. How suppliers achieve dispatchability that should be up to them.

It is irrational to impose these burdens on ESKOM, especially in a new dispensation in which ESKOM is expected to be rationalised and competitive.

IRP2023 should, we submit, provide for immediate electricity trading, so that people with existing or new generating capacity, regardless of the mode or mix, may bring an end to the crisis. The precondition of stifling NERSA licences should be scrapped.

6 Questionable Assumptions

6.1 Economic Growth Assumption

Electricity and prosperity coincide. One of the strongest corelations to be found in economics, or any social science, is the virtually ratcheted connection between a country's wealth (GDP) and its electricity generation.

What this suggests is that (a) there cannot be economic growth without increased generation, and that (b) increased generation increases prosperity.

IRP2023 assumes slow economic growth initially and faster growth down the line due to the government's 'aggressive' economic growth reforms.

In this, IRP2023 is mistaken. The government does not have, but should have, policies that will stimulate growth. The future high growth sentiment has been expressed repeatedly since stagnation set in 15 or so years ago. In the absence of high-growth policies, IRP2023 should presume continued growth at current levels.

If IRP2023 allows for substantially increased capacity, higher growth induced by it can be assumed from when such capacity is provided.

6.2 Generating Capacity of Old Coal Power Stations.

Some scenarios assume that current coal power plants can be returned to levels of functioning close to their peak levels. Before high levels of generation can be assumed, there must be incontrovertible evidence in IRP2023 that such levels are affordable. This not a engineering, but a business economics consideration.

That said, the existing fleet should be used to the fullest extent consistent with what is technically and economically feasible.

6.3 Phasing Out Coal.

IRP2023 assumes that coal power stations will eventually be phased out. Given South Africa's enormous coal deposits, the opposite should be assumed, that this endowment will be used sensibly. If the motive is climate change mitigation, South Africa should not, for a relatively trivial contribution, sacrifice prosperity.

Extending the use of coal is desirable, especially given South Africa's coal abundance. However, as stated, assumptions of the government's growth prospects, and getting coal plants to original capacity appear unrealistic.

Acknowledging a possible trade-off with emission commitments is honest and sensible, although worthy of serious reconsideration.

6.4 Transmission and Distribution

Assumptions around transmission and distribution networks, capacity and availability do not go beyond already approved projects. There should be realistic planning and assumptions for future projects.

ESKOM must provide baseload power and grid integration.

It assumed to be legitimate for ESKOM to be compelled by outsiders to fund and provide baseload or backup power for renewables.

This is a gravely flawed assumption. If ESKOM wants to do so for some reason, which is unlikely, it should be allowed, but it should not be forced on ESKOM in PPAs at the behest of IPPs.

Eskom should be free to purchase only fully secure and dispatchable power. It should also be free to require IPPs to provide or fund grid integration.

It should not, as now, be required to provide baseload power for renewable energy providers. It is irrational to ask Eskom to pay a fence price for renewable energy that is not needed, that will not be used or get to the end user in any way, and then expect it to provide a duplicate the power generation system.

All providers should be asked to ensure their power is firm (dispatchable), and they should bear the price of connecting to the power grid.

Artificially inflating that price because of CO2 emission commitments is doubly irrational.

6.5 Barriers to success.

IRP2023 does not address known barriers to project success or project certainty.

There is no indication that the IRP exercise models the effect of non-payment, theft, corruption, sabotage, managerial incompetence or labour unrest on the timeline, and the costs these impose on new energy initiatives.

IRP2023 make the unreasonable assumption that all those influences will be eliminated. This is surprising considering that these factors are responsible for much of Eskom's troubles. This failure ensures that the IRP will cost more and take longer than planned.

Best practice worldwide is to look at the statistics of projects that have been completed, for example, Kusile Power Station. That project's cost and time overruns are just shy of triple the original estimates so far and the project is still not wholly complete. Realistic planning would use statistics like that to increase the estimated costs and timelines in the model.

6.6 Other questionable assumptions

Other questionable assumptions are addressed above. These include the assumption that there should, under changed conditions, be IRPs at all, that NERSA should remain a market regulator, that ESKOM unbundling is for others to decide, and that ESKOM should not be 'liberated'.

7 The Failure of Central Planning relative to Markets

We propose only realistic and readily achievable policies. Reflections on ideologies, such as 'pure' nationalised and centrally planned socialism, or totally privatised and liberalised markets, are important, but not for real world policy planning.

Central planning, even using sophisticated linear programming, is at best a limited simplified approach that assumes a system isolated from other concerns. Compared to relatively open markets and the price mechanism it is extremely inefficient. It cannot consider changes in the relative value people place on energy and other factors like health. There will be distortions in the market and therefore a less than optimum balance of values.

For example, the National Electricity Regulator of South Africa's (NERSA) price controls cause and exacerbate electricity shortages by keeping prices artificially low. The government will say that NERSA's involvement is to ensure that those who cannot afford to pay market rates for electricity are not denied power. That however, as indicated above, should be a welfare function, like social grants. ESKOM, or any energy producer, should not be burdened by such extraneous requirements.

The IRP appears well thought through and provides for a more realistic energy/electricity mix than before. It also acknowledges that there may have to be compromises, notably between having a secure energy supply and meeting emission commitments, but remains too optimistic regarding the latter and renewable energy.

In particular, as explained above, IRP2023 unrealistically does not consider the risk to such projects inherent in the unlawful behaviour plaguing the country.

IRP2023 suffers from eschewing – not doing justice to – the much productive and efficient approach of opening the market to freedom of enterprise.

8 Insecurity of Funding

Other than the direct cost of a secure adequate clean power supply, the IRP should be realistic about competition for funds by rival budget plans, such as the NHI or social grants. These programs are also likely to be more costly than anticipated.

Despite what IRP2023 and NHI promise – the two biggest projects in the nation's history – nothing has been budgeted for either. The IRP should indicate which elements programs would win and lose should there be insufficient funds to pay for all of them, as seems extremely probable.

IRP2023 ought to have considered security of funding (perhaps to the extent of modelling it), but has not. It should acknowledge that there will be compromises with other state projects and these compromises should be publicly debated. The chances of projects failing through the state's inability to pay for them, are not trivial. The odds of the IRP being a success in its current form are, for this reason alone, low.

9 Non-experts and IRP2023.

The general public and people entirely lacking expertise have been encouraged to participate. This can be no more than a publicity exercise, since it could not possible yield meaningful inputs. A central plan as technologically and economically complex as this ought to be decided entirely by experts.

However, even expert central authorities cannot know how energy requirements fit optimally into the mix of needs in the present, and have even less idea of the future. Flexibility is essential in that context, and an open market is flexible where a central plan is not.

10 Short, Medium and Long-Term Solutions.

IRP2023 does not provide for short-term solutions. It's two time periods are medium- and long-term.

Short-term solutions include:

The price mechanism could literally end power shortages overnight. This is basic economics. All that is needed is for prices to be increased to the point where demand falls to supply. This fact does not suggest anything that radical, but it does suggest substantial immediate prices increases. The welfare aspect should be dealt with separately, as above.

Would that be unpopular? Of course it would, but not as unpopular as loadshedding and blackouts. It could be explained easily that higher prices will lead to savings through lower consumption, and continual supply.

It is not, of course, IRP2023's purpose t be popular, but to make workable proposals.

Another known short-term solution is power ships. IRP2023 should recommend them as a matter of extreme urgency.

The immediate liberalisation of electricity trading would also go a long way towards solving the power shortage in that people will be incentivised to generate maximum power according to their capacity to generate income.

11 Conclusions from Part 1

11.1 IRP2023 should address the role and relevance of an IRP in the absence of a single operator monopoly.

11.2 ESKOM should be ‘liberated’ to operate as it wishes.

11.3 Simultaneously, the electricity market should be ‘liberated’.

11.4 NERSA interference should end, and NERSA should regulate standards not the market.

11.5 Questionable assumptions should be questioned.

11.6 Nuclear should be a central and urgent feature of IRP2023, with government and private operators, and with government nuclear being located within NECSA.

11.7 Prices should be increased towards matching demand with supply.

11.8 Coal should be used indefinitely.

11.9 Renewable suppliers should supply dispatchable power at their expense.

11.10 Short-term solutions should be included in IRP2023.

Part 2

12 Why an Integrated Resource Plan (IRP) at all?

While acknowledging the worthy intentions and qualifications of its compilers, the concept of a government department determining an IRP is fundamentally flawed.

These introductory comments to Part 2 echo those of Part 1. The observations are so crucial that the bear repeating in this alternative form.

In a vertically integrated government monopoly, such a task should not be the function of DMRE, but rather that of the operator's, that is Eskom's, executive. In an unbundled system, it would fall under the purview of Eskom's transmission and generation companies.

In either scenario, the responsibility for an IRP lies with those who are closest to and best informed regarding what is and should be planned, notably the system operator. The system operator presumably does and certainly should possess the knowledge and qualifications to determine the most suitable electricity systems for the nation's daily electricity supply and demand.

The mere fact that South Africa's electricity mix did not align with the predictions of the IRP2010 or IRP2019 questions whether IRP2023 will not make the same mistakes as before.

Furthermore, it is unclear why there should be public participation in determining the corporate plans of the government's autonomous operator and of South Africa's electricity mix. Pick 'n Pay, for instance, does not have an integrated grocery or bread plan, nor does Avis have an integrated vehicle plan. If such plans exists, they are and should not be determined by public consultation, nor be open to the public and competitors.

Failures of the IRP process are not unique to South Africa. They are endemic to other country's IRPs. The Australian IRP of 2023, for instance, obscured the added cost of renewables to transmission and distribution, burying it deep within an annex of the report as a "sunken cost" (click here for link). This effectively concealed the true full system cost of renewables until an activist exposed it.

The Australian IRP, like its South African counterpart, also uses the credit agency Lazard, which has been shown to not be based on international benchmarking and audited accounts, in particular as it relates to Nuclear Power (click here for link).

It is as erroneous to assume that a government department can accurately plan or predict a country's energy mix with a computer model as it would have been for Nostradamus to possess the knowledge to foresee the end of the world.

The flawed assumption that a government department can accurately predict a country's energy demand and mix, and subsequently find solutions to be implemented, through the issuing of tenders attracts serious criticism from all who know and care about South Africa's energy future.

In an ideal world, there would not be an Integrated Resource Plan (IRP), nor any five-year electricity plan, given the failures of such policies and plans historically.

A basic principle in risk management is to not assume a biased position that performance will always improve, but rather to be on the lookout for errors that might occur in the system. In fact, this failure in risk management may have been a contributing factor to the failure of IRP2019 in predicting South Africa's future electricity needs and mix, and the various stages of loadshedding currently inflicted on the country.

As shown in Table 6 from IRP2019, Eskom predicted an Energy Availability Factor (EAF) of 73.36% across the coal fleet for 2024.

Yet in 2023 as per Eskom's own data, Eskom's EAF was closer to 50%.

Table 6: Projected Eskom Plant Energy Availability Factor

IRP 75.5% EAF FY2025 to FY2031 : EAF												
STATION	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
ACACIA	98.40	98.39	82.34	98.39	89.66	96.82	98.63					
ANKERLIG	98.12	94.20	98.13	96.81	97.81	95.16	88.12	98.07	95.89	95.81	95.55	95.70
GOURIKWA	95.88	94.03	97.70	97.44	98.00	91.56	91.63	97.46	96.02	95.52	95.48	95.65
PORT REX	97.71	93.07	92.46	92.62	98.14	96.16	97.91					
GARIEP	98.77	95.96	89.94	98.75	96.95	91.95	96.90	92.94	89.40	94.61	94.15	93.95
VANDERKLOOF	94.73	98.87	88.95	84.44	98.85	97.61	98.45	97.91	95.73	95.05	95.09	94.67
DRAKENSBERG	75.36	84.72	81.29	91.09	90.05	83.22	89.90	85.90	86.07	85.31	86.43	86.53
INGULA	93.28	98.92	94.37	94.71	97.35	90.85	91.39	90.68	90.54	93.56	93.60	93.00
PALMIET	86.05	98.83	94.45	87.89	98.80	88.92	97.50	92.85	92.90	93.11	93.90	93.36
PEAKING	91.79	94.34	92.47	94.31	96.20	91.16	91.88	93.18	92.11	92.96	93.13	92.99
KOEBERG	84.16	82.96	70.32	90.08	86.46	74.93	90.04	89.50	92.11	84.50	84.54	84.72
NUCLEAR	84.16	82.96	70.32	90.08	86.46	74.93	90.04	89.50	92.11	84.50	84.54	84.72
ARNOT	65.08	62.44	65.36	62.27	62.82	65.48	69.37	67.42	60.80	54.54	54.58	
DUVHA	54.48	49.67	60.16	56.92	62.82	61.12	67.22	63.65	59.44	60.91	60.21	59.80
HENDRINA	60.93	55.96	69.35									
KENDAL	69.10	71.34	65.47	73.17	69.03	74.14	75.36	69.41	79.33	73.64	72.94	72.53
KRIEL	54.10	63.42	54.63	51.39	65.20	64.44	65.39	68.89	51.12	60.54	64.15	
LETHABO	73.98	72.38	75.61	71.00	70.41	74.88	68.47	67.91	68.82	74.06	73.36	72.95
MAJUBA	73.05	74.62	75.32	72.62	74.50	77.04	70.13	72.18	71.93	71.63	70.93	70.52
MATIMBA	82.75	80.14	81.64	81.12	81.20	78.37	79.35	78.79	76.45	80.11	79.41	79.00
MATLA	67.30	68.76	70.74	70.97	69.49	70.53	69.66	69.10	75.96	70.37	69.67	69.26
TUTUKA	56.06	56.86	54.05	59.15	54.92	61.15	57.84	57.37	62.55	58.78	58.08	57.67
BIG 10	66.78	67.18	67.69	67.53	68.44	70.41	69.46	68.57	69.48	69.49	69.43	69.20
CAMDEN	60.00	55.81	61.24	64.67	63.05							
GROOTVLEI	89.15											
KOMATI	87.39											
TOTAL RTS	63.21	55.81	61.24	64.67	63.05							
Current Fleet Tota	71.00	71.53	71.40	72.71	73.63	73.85	73.96	73.36	74.23	74.06	74.28	74.31
KUSILE	72.00	76.55	83.72	81.44	81.62	83.16	78.21	82.41	81.67	80.12	79.42	78.94
MEDUPI	76.64	79.23	84.22	83.58	85.20	81.90	85.99	86.66	79.52	81.76	81.06	80.58
NEW BUILD	75.31	78.29	84.00	82.54	83.42	82.53	82.12	84.55	80.59	80.95	80.25	79.77
ESKOM TOTAL	71.5	72.5	73.5	74.5	75.5	75.5	75.5	75.5	75.5	75.5	75.5	75.5

By implication, IRP2019 predicted that Eskom would have had 10 GW more power than it is currently able to generate. The difference is a loss of Eskom's 'Safety Margin' (5 GW) and 5 stages of load shedding. This is what South Africa is experiencing today.

IRP2023 repeats this mistake as the graph below shows. This oversight means that DMRE has a plan that assumes an improvement in Eskom, despite the more likely scenario being a drop in the EAF, shown in red below. This should raise major concerns in the eyes of the public, because it could imply that even more loadshedding is on the horizon, and that the government is ignoring this deliberately.

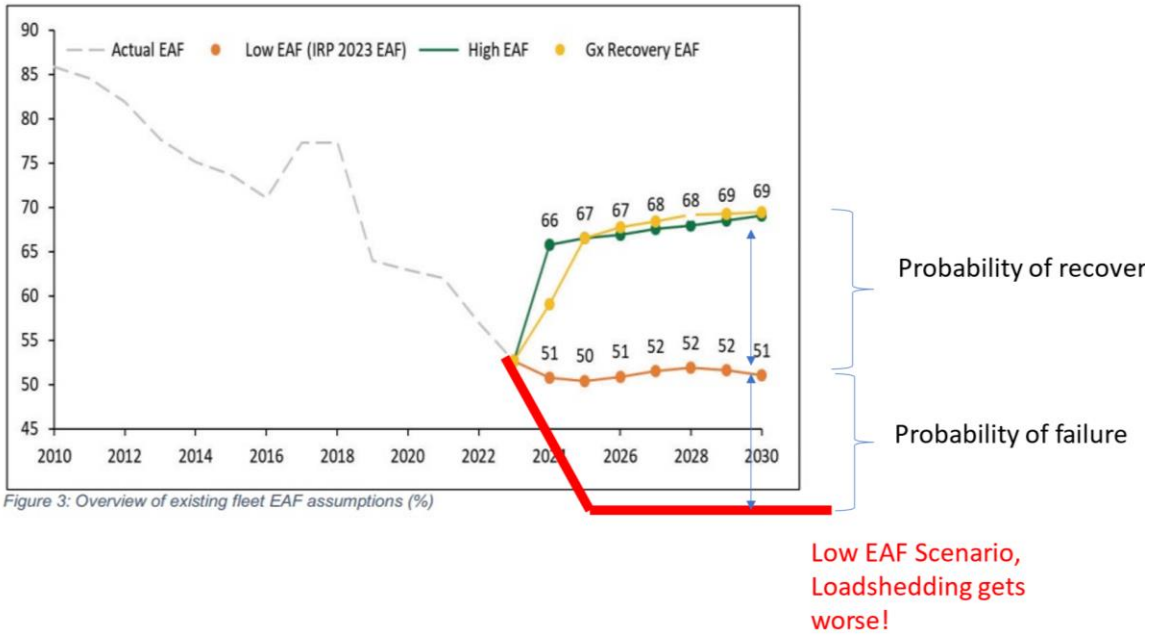


Figure 3: Overview of existing fleet EAF assumptions (%)

Eskom's current shortfall with a 50% EAF is around 13 GW. With a further deterioration to 30% over the next decade, South Africa will need an additional 10 GW, a total of 23 GW, just to replace the existing coal power stations.

The IRP2023 ignores this major risk.

By making this mistake, the most unconstrained option to alleviate loadshedding seems to be neglected: a genuine commitment by Eskom's leadership and DMRE to invest more in fixing the broken coal fleet, which includes bringing back the abandoned coal power stations and those around the municipalities.

This suggested pathway was allegedly recommended to South Africa's Presidency and Treasury after the release of Sir Mick Davis's report. Davis, a former Chief Financial Officer of Eskom, advised President Ramaphosa and the rest of the cabinet in 2019 on a turnaround strategy for Eskom. His 9-point plan, which addresses the state of Eskom, is shared with every Eskom CEO candidate. Three former Eskom CEO candidates, as well as various people close to Davis have expressed that, based on this report, they would consider addressing the issues with the coal fleet so that South Africa could buy time to explore alternative energy options.

One candidate referred to Eskom's 2020 submission to the Portfolio Committee on Public Enterprises. As shown in the figure below, the submission included a 9-point turnaround strategy that focused on new plants, full load losses and trips, units on long-term forced outages, partial losses and boiler tube leaks, outage duration and slips, human capital, preparation for increase OCGT usage, a reduction of emissions, and coal management. These points mostly speak to an improvement in the coal fleet. See Figure below.

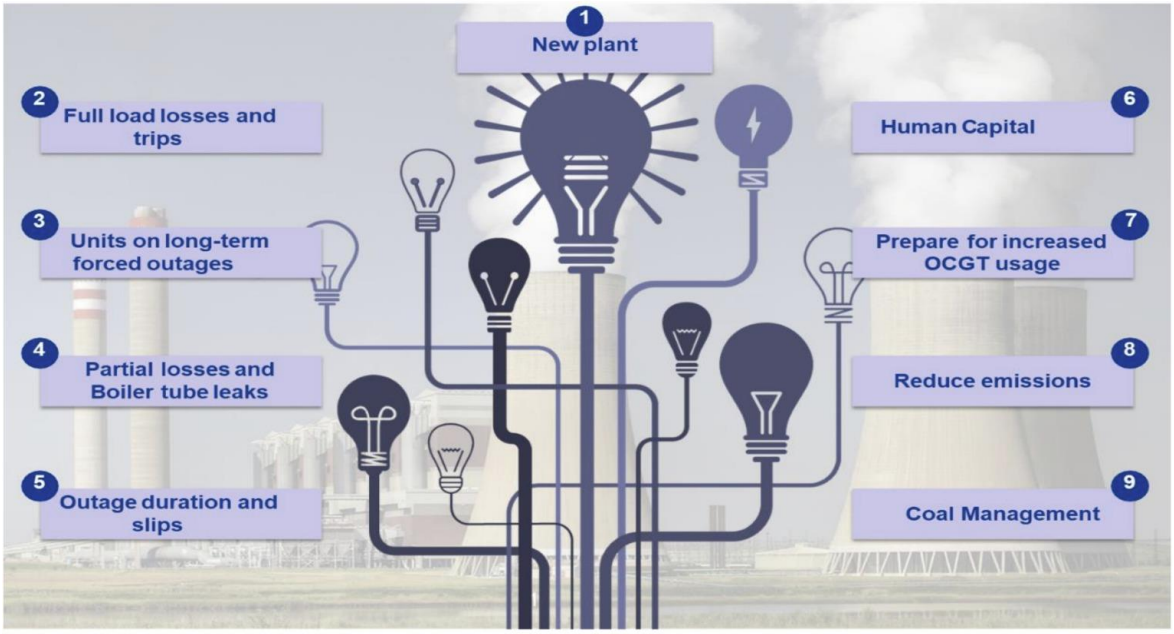


Figure: Submission to the Parliament Portfolio Committee in 2019, based on Sir Mick Davis's Recommendation.

Davis was not the only expert to point to the broken status of the coal fleet. Dr Frans Cronje (click for link) also proposed this pathway during the investigation into Eskom's decline by the Social Research Foundation. In addition, the recently released VGBE energy report (click for llink), which the government kept secret for almost 6 months, as well as the submission to the IRP by Meridian Economics, have indicated that fixing the coal fleet would be the least-cost option

By not providing for fixing the coal fleet comprehensively, IRP2023 is making the same mistakes as in 2019. Fixing the coal should be the greenfield option.

13 What should an Integrated Resource Plan Achieve?

A credible IRP should present various scenarios for a country, all of which should be compared to the greenfield scenario of "fixing the system".

A '*greenfield scenario*' typically has the lowest Total System Cost (TSC) since amortized assets are generally easier to maintain compared to constructing an entirely new system. The IRP2023 neglects coal and fails to consider the possibility of reviving Eskom's abandoned power stations (click for link).

This should be the greenfield scenario.

The additional scenarios could include:

1. A scenario incorporating solar power, wind power, hydropower and stating the additional costs required to upgrade the transmission and distribution system, as well as the cost of baseload backup.
2. A scenario involving nuclear power and upgrading the transmission infrastructure, with total system cost calculated.
3. A scenario focusing on traditional fossil fuels, notably a commitment to coal and liquefied natural gas (LNG).
4. IRP2023 should also consider various hybrid scenarios combining elements from the above options.

Recognizing that electricity is just one component of the energy sector, and there are numerous energy markets within South Africa that the IRP cannot possibly foresee, such as electricity generated from rooftop solar, diesel generators, or even on speed boats.

In the absence of perfect data IRP2023 should not make strong conclusions. It should rather accommodate and openly state the variation in its conclusions. It should be open about the fact that many of the new builds will probably run into cost overruns.

Concerning electricity demand, there's a need for thorough scrutiny. A basic cross-product analysis suggests that as a heavy-industry economy, South Africa should aim for 70GW of electricity (1GW for every million people).

However, none of the reference scenarios cited in IRP203 comes close to this number. If this disparity is due to the government's shift away from heavy industry and towards a service sector then such assumptions about the nature of the economy should be stated explicitly.

Several remedies for the IRP are proposed, notably that the various pathways should not be prioritized.

Instead, total system cost, effects on tariffs, the cost of additional transmission lines, and the cost of the distribution network, as well as the potential premium for a more "expensive" pathway, should be disclosed.

1. The premium to be paid on decarbonisation should be disclosed.
2. The South African public, government, and investors should be empowered to decide whether it is worthwhile to invest more for better electricity.
3. The public should decide if the “social cost of carbon” is a cost or a benefit. Which it is, is by means as obvious as popularly assumed.

The current IRP2023 in its draft concept falls short of what should ordinarily be required and therefore its conclusions should not be accepted.

An Integrated Resource Plan (IRP) should not be based on the “least cost” metric, but rather opt for the highest “value for money” metric. The findings of the Zondo commission (click for link) concluded that South Africa’s national interest is best served using this metric.

> “Ultimately, in the view of the Commission, the primary national interest is best served when the government derives the maximum value-for-money in the procurement process and procurement officials should be so advised.”

14 Flawed Technical Assumptions in IRP2023

IRP2023 needs to provide an uncertainty bracket for its estimates and show the total system cost of its scenarios along with associated uncertainty brackets. Moreover, it should differentiate between the highest value for money metric and the least cost metric, explaining the rationale behind using the least cost approach.

As mentioned previously, the lack of reflection on why the IRP2019 failed is concerning, as is the absence of evaluation regarding whether Monte Carlo Simulations, differential equations, or Plexos software are suitable for the applications involved. The quality control procedure and model stress tests should be made public, along with the names and qualifications of the modellers and assessors. TiE has issued a PAIA act requesting this data because to date it has not been made public.

IRP2023 cannot be accepted if the quality control procedure is not disclosed. Is it ISO9001 compliant for example?

Furthermore, IRP2023 overlooks crucial aspects such as Eskom’s reserve margin, potential disastrous outcomes like a rapid decline in Eskom’s Energy Availability Factor (EAF), and

the situation of abandoned coal stations, which could alleviate loadshedding. A breakdown of EAF for each plant and unit is also missing.

Additionally, IRP2023 does not take account of the predicted expansion of rooftop solar, and includes a nuclear scenario despite effectively locking out vendors. The anticipated GTP and the cost of nuclear power might be underestimated, and reliance on benchmarks like Lazard is questionable.

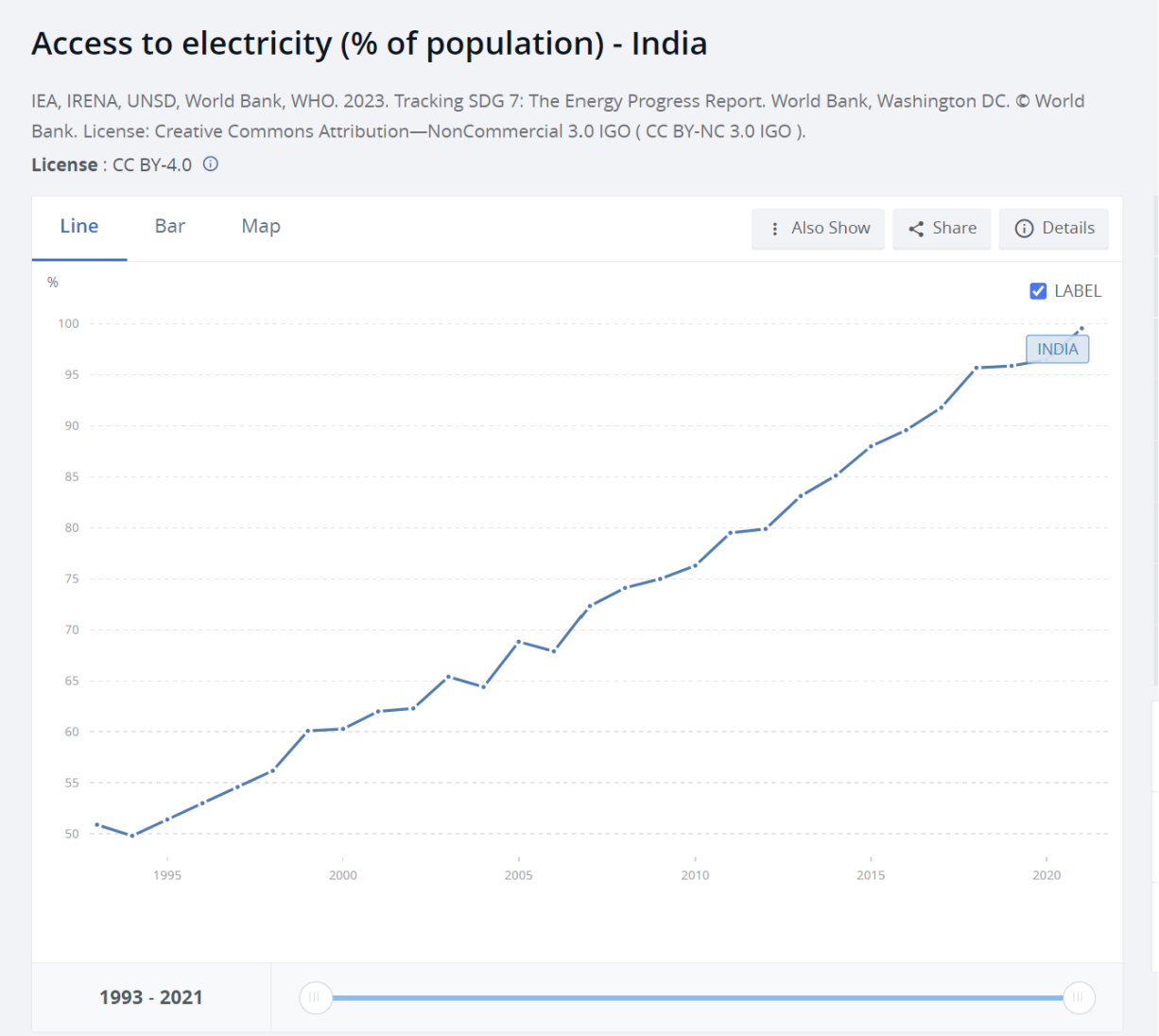
The spreadsheet data lacks clarity, making it difficult to interpret. The cost of renewables should, as stressed above, encompass all costs, including transmission line costs, distribution costs, the need for duplicate baseload capacity, and adaptation to the distribution network. The pace of building transmission lines seems overly ambitious, and the feasibility of carbon capture and storage (CCUS) remains unclear. The IRP neglects South Africa's 5GW pumped storage potential (click for link), which could aid in integrating renewables as opposed to battery storage solutions.

IRP2023 should assess the impact of renewables on the full system cost of electricity for various thresholds and make provisions for Small Modular Reactors (SMRs), and the impact of recent energy discoveries internally and in neighbouring regions.

15 Data Transparency

The breakdown of the total system cost for each reference pathway should be transparent. DMRE should express the following data of each scenario.

1. The impact on the unsubsidized electricity tariff to the end user.
2. The full system costs for transmission lines, including estimates for project overruns, such as those experienced with Medupi and Kusile.
3. The full system cost on the distribution system, including estimates for project overruns.
4. The social costs and benefits – copious benefits tend to be denied – of CO2 emissions. Assumptions about the perceived dangers of CO2 should be made with consideration for South Africa's status as a developing country richly endowed with coal. It is worth noting, as depicted in the graph below, that coal has been hugely beneficial to India over the last 20 years, aiding in achieving universal electrification. Millions of people will suffer from *not* burning coal.



1. Impact on water usage.
2. Estimated job creation.
3. The percentage difference between reference pathways as well as the uncertainty.

This transparency is essential for stakeholders to understand the premiums associated with different pathways.

Part 3

What follows has graciously been contributed by Dr Rob Jeffrey. His doctoral thesis should be studied for and should inform IRP2023.

16 Assessing The Actual Cost of Alternative Electricity Generating Technologies in South Africa in Line with Its Economic Development Requirements

Dr Jeffrey's doctorate was received in early November 2022 and the PhD conferred in early 2023 by the University of Johannesburg. This document should be used as a basic guideline in assessing South Africa electricity generating requirements and those of many other countries.

A few findings are raised below and should be noted for the current IRP.

17 Abstract

Emerging and developing economies rich in fossil fuels should fully use the natural resources that give them a comparative economic and competitive advantage. The significant elements and factors required to make such a decision were evaluated. In South Africa's case the primary energy resources used were its coal and coal reserves in South Africa's case. Furthermore, the country also has substantial quantities of uranium. Because of these uranium reserves, nuclear power generation should also be a significant energy source. Finally, the country has existing skills and resources in these technologies, reinforcing these technologies' use. The study emphasised the requirement for reliable, secure power at the lowest financial and economic cost. At this economic and technological development stage, all other energy sources are for backup purposes or to fulfil specialist regional or business needs.

18 The Objectives

The recommendation in South Africa is to move back from the efficient energy sources provided by fossil fuels, primarily coal, to renewables such as solar and wind, supported by gas (Fraunhofer, 2016). There are many reasons for reversing this process, including supposed improvements in productivity and lower costs associated with renewable energy (May, Andrew, 2017). However, the primary reason is that the additional carbon dioxide produced due to the human use of fossil fuels significantly impacts the climate. The increase in carbon dioxide levels and the purported Anthropogenic Greenhouse Gases (AGG) released by coal causing higher temperatures are becoming an existential threat to human and animal existence on Earth. The impact will affect all nations, both developed and developing nations. Many experts do not accept that human-generated carbon dioxide significantly impacts climate and global warming (Berry, E. (2019a, b, c; Burnett, S. (2017; Dayaratna, K., Mckitrick, R. and Kreutzer, D 2017, European Climate Declaration ECD (2019)). Most developing economies have three critical problems and hence three vital economic objectives. These objectives are reducing inequality, reducing unemployment and reducing poverty. South Africa is no different, and these are its primary objectives.

South Africa is blessed with a treasure trove of natural resources (T Manuel, 2017). It also has a population with the abilities and cultural diversity to develop them. It is indeed a country with enormous possibilities and opportunities, and, in addition, it offers a gateway and hub to a continent with a vast market and economic growth potential. Yet South Africa is at a crossroads in its economic, social and political development. Hard choices need to be made, which will determine whether the country will grow and help its people prosper or sink into a long period of slow growth, stagnation, declining standards of living, steadily rising unemployment and increasing poverty (Nicolson, G. 2015). Much will depend on the vision and courage of its political and business leaders in fostering a spirit of cooperation and

support from all citizens and groups (Bohlmann H. R. et al., 2019). In particular, the choice of energy sources affects all sectors. The mining sector has shown little or no growth for decades. Since 1986, the mining sector has fallen from representing about 13% of gross domestic product (GDP) to 7% of GDP. The secondary sector has fallen from 30% to approximately 21%. The tertiary sector has grown from 51% to 69% of GDP (Economic Development Department; Sarb; Economic National Treasury; Jordaan J Economic Modelling)

19 Environmental Factors and Carbon Dioxide Emissions

There is sufficient expert evidence to support the view that Anthropogenic Global Warming (AGW) is not the critical issue made out by the IPCC. Carbon dioxide is not the damaging gas it is made to be (Climate Depot, 2010; Aldersey-Williams, 2018, 2021; Kauppinen and Malmi, 2019; Barbalace, R.C. 2006). This evidence supports those developing economies with a comparative advantage in fossil fuels, such as South Africa, should explore alternative electricity generation options and not exclude coal and fossil fuels because of potentially damaging environmental factors. The detailed analysis shows that the potential costs of moving away from coal far exceed the potential benefits that South Africa may gain by using renewables. Such adverse effects are not proven and are uncertain. By being aware of potential negative consequences, the authorities can mitigate any possible harmful effects by utilising technical advances that have been made in these electricity generating fields.

20 The Importance of Coal and Gas to South Africa

The detailed examination of the country's coal and possible gas resources was revealing. It highlighted the importance of coal in South Africa's economic development and its relevance to mining and industry and the industrial heartland of South Africa in Gauteng. An examination of the importance of South Africa's mineral resources and commodities in the balance of payments was reviewed. It established that any reduction and ultimate destruction of coal mining and coal use for electricity generation could significantly affect the economy. The negative impact would be felt by the coal industry, industries dependent on it, and the entire mining industry, with severe detrimental economic implications. It scrutinised the potential for developing a gas industry and the role it could play in creating a new industry in South Africa. Importantly it highlighted the need to find local deposits for gas to make any substantial contribution to South Africa's energy requirements and economy. Substantial imported gas would be highly damaging to the economy. The best opportunity lies in finding substantial shale gas in the Karroo.

21 The necessity to reindustrialise and redevelop the mining industry

The past few decades have seen radical deindustrialisation of the economy. The 26 years from 1980 to 2016 have seen the situation worsen, with GDP growth falling to below 2%. (Source: SARB). Growth in mining and manufacturing has been negligible, while agricultural growth has averaged only 1% yearly. Financial services and personal service growth have averaged 2.4% and 2.8% a year, respectively and government services 3.3% a year (SARB South African Reserve Bank (2018)). The low growth in manufacturing and mining has resulted in severe structural economic problems.

The mining and manufacturing industries account for over 60% of the country's exports. Little wonder South Africa has faced a deficit in its trade balance. These two industries and agriculture tend to employ proportionally fewer skilled workers. It should be noted that as the economic growth rate falls, there is a tendency for the trade deficit to decline, and a trade surplus did return. This improvement in the balance of trade is not a positive result. In fact, it is more frequently a negative result. There are usually two primary reasons for this change in the trade balance. Domestic demand for goods falls, particularly as the exchange rate deteriorates and goods become more expensive. But domestic and foreign direct investment

also falls. Under these circumstances, the decline in the demand for capital goods shows slower future growth and a growing lack of confidence in future economic growth.

Since 1995, the population has grown from 45 million to over 60 million, and unemployment has grown from 3.7 million to over 8 million. It is now over 40%, one of the highest unemployment rates in the world. From 2008, only half a million jobs have been created, almost all of which have been in the services sector, primarily in the public and government sectors. Unemployment is forecast to increase by over one million by 2022. This growth in unemployment is unsustainable. Quite correctly, there have been calls from the essential goods-producing sectors, namely mining, manufacturing and Agri-processing, to the government to assist in creating growth in these sectors.

22 Electricity Growth Needs for South Africa

The country's economic growth needs and the GDP growth potential required its primary objectives of reducing poverty, inequality and unemployment were examined (Cilliers, A. (2020)). The structural and sectoral industrial and economic growth requirements were also evaluated (Maladoh Bah, M. and Azam, M. (20170; Prinsloo et al. (2019); QEO, E. (2019)). These require growth in the economy's more electricity-intensive industrial, manufacturing and mining sectors. It reviewed and forecasted the likely electricity-generating demand for alternative sectoral growth strategies in the debate regarding environmental change and the discussion concerning "clean-coal" energy and the use of renewables. At this stage, the selected long-term sustainable growth rate of 3.8% per annum was considered the country's maximum long-term sustainable economic growth.

Electricity	4,000 MW	8,600 MW
GDP	R300 bn	645 bn
Employment	800,000	1,720,000
Dependents	3,200,000	6,880,000

Source: EconomicRisk, Estimates based on SARB, StatsSA

The figures estimate the potential beneficial economic impacts of approximately 4,000 MW of electricity and 8,600 MW generated by several power stations. The data are rough estimates taken from Eskom and StatsS.A. but give a reasonable idea of the potential impact of electricity generation on South Africa's economy and future growth StatsS.A. (2015,2016,2019).

It should be noted that the above economic impacts can only be delivered by dispatchable electricity generating sources such as gas, nuclear and "clean-coal" (Minchener, 2016). The economic benefits above cannot be provided by non-dispatchable electricity-generating solar and wind sources. Wind and solar deliver electricity less than 30% of the time, and not only that, but the supply is also variable, unpredictable and interruptible. In other words, there is a high risk of non-supply of electricity which is unsuitable for business and industrial development. Divide the above benefits by three if one selects a renewable build programme. In summary, it suggests substantial economic advantages in researching other dispatchable electricity generating sources before considering any investment in variable, unpredictable interruptible renewables such as solar and wind (Joskow, P. L. 2013). Solar has a potentially important role in domestic use and office development.

The growth in electricity generation of 3.0% per annum and the resulting higher generation capacity creates the potential for higher GDP growth, higher employment, lower unemployment and a higher standard of living. This growth target assumes that policies are implemented to encourage higher growth in industry and mining-related activities. Employment growth would be roughly 3.4% per annum. It can be anticipated that there will

be consistent growth in exports at 3.8% per annum. Imports would rise in the same proportion. Suppose there is a weaker Rand, combined with more bias towards mining and manufacturing. In that case, it can be anticipated that there would be higher exports, lower imports and more unskilled people employed. Similarly, the electricity growth required would increase above 3.0% per annum to support this growth.

In summary, small electricity generating capacity increases would ensure lower economic growth. Slow growth would become a self-fulfilling prophecy. It would justify the inadequate planning and capacity decisions made previously. The resulting outcomes are detrimental to South Africa as it would reduce employment growth, increase unemployment levels, and result in a lower standard of living.

23 Comparison of the Costs of Generating Electricity

It is critical to evaluate the actual cost of generating electricity for each technology to determine the least-cost energy mixture. Examining the strengths and weaknesses of the methodology currently favoured by renewable lobby groups and energy planners in South Africa and elsewhere is necessary. The least-cost mix is determined by utilising the Levelised Cost of Energy. A detailed analysis concludes that electricity delivered is not equal when a distinction is made between dispatchable and non-dispatchable power (Aldersey-Williams, 2018). In particular, the quality and price or cost at the gate of the supplier and the cost of energy supplied to the user differ. The impact of the load factor and the life of the technology are discussed. The role of risk and uncertainty and the Cost of Unserved Energy (COUE) must be included in any calculation to determine the actual cost of each technology. It is integral to the technology cost structure and must be included in calculating these technologies' actual electricity generating costs. On this basis, the analysis showed that the cost of renewables, defined as wind and solar, was significantly more expensive than HELE "clean-coal" and nuclear (American Interest 2016). The potential economic damage of wind and solar is excessively high due to the risk and uncertainty caused by their inherent variability and unpredictability (America's Power 2019). These are unacceptably high for almost all economies, particularly developing industrialising economies. The model developed and utilised can be utilised in different countries and various economic situations down to the state or regional level in a country. The analysis concludes that by any measure, the cost of wind and solar as power sources for an industrialising economy such as South Africa is significantly higher than that of nuclear and coal. In South Africa, coal-generated electricity is cheaper than nuclear power.

Emerging economies need to focus on those technologies which are efficient and effective. In South Africa, goods-producing industries, particularly mining, manufacturing, agriculture and industry, need dispatchable electricity supply security at competitive financial and economic prices. This country's only two domestic electricity-generation energy sources that can achieve these objectives would appear to be nuclear and High-Efficiency Low-Emissions (HELE) coal, otherwise called "clean coal" (Endfield and Others 13 November 2019, Bill Gates). Sometime in the future, sufficient domestic gas may be discovered.

The country must raise its economic growth rate by ensuring a sustainable, secure, dispatchable electricity supply at the lowest financial and economic cost (World Nuclear Association. (2019)). Supporting conditions are required to foster domestic and foreign investment in its economy (Jeffrey, 2016c). The arguments above show clearly that renewables in the form of solar and wind, in particular, almost certainly have substantial additional costs that are not fully accounted for in the current prices. These additional costs that are not included mean that the so-called least-cost optimum mix is wrong. As a result, this methodology is severely flawed as currently defined and used.

Furthermore, increased penetration of technologies such as solar and wind, variable, unreliable, intermittent, and unpredictable, will automatically lead to a higher optimum mix cost. Finally, the risk and uncertainty posed by solar and wind lead to rapidly increasing

economic costs measured by the COUE. These are not currently allowed for or measured accurately in current models associated with the least-cost energy mix (Henderson, D.R. Hooper, C.L. 2017). The impact and economic COUE set out by the IRP in 2019 is approximately R87.85/kWh. The 2016 IRP sets these costs at R75/kWh. The technique and methodology recommended using statistical methods based on variable estimates utilising each technology's variance and mean to calculate the COUE and the risks associated with each energy source.

24 Wind power is not cheaper than coal or nuclear

The second blatant flawed argument is the myth that wind power is far cheaper than coal-fired or nuclear power (Hughes, G. and Barnett, Lord 2012) Sloan Judith (2016). This argument for cheap renewable is dispelled by an *Australian Research study by GHD and Solstice Development Services entitled 'HELE Power* Station Cost and *Efficiency Report'*. McGee, J. A. and Greiner, P. T. (2019). This report estimated that with efficient construction and production, generation costs would be between 41.3c/kWh and 80.5c/kWh. These costs should be compared to Kusile estimates running at about R1.20/kWh and the latest estimates for nuclear of R1.20/kWh. Many unreliable and false reports on energy climate change and costs are involved even when they claim to be peer-reviewed (The Economist, *(2018)* Shuttleworth M (2009); Gyles C.2014*).*

Furthermore, this price is for power generation over 80% of the time. It is far cheaper than wind and solar, which are quoted between 62c/kWh and 65c/kWh. However, they generate power less predictably (Boretti, A., 2019). Wind, on average, is productive for less than 35% of the time and in the case of solar less than 26%. A simple calculation shows that on a comparable basis, the equivalent price for power 80% of the time is a minimum of R1.48/kWh.

25 Adjustment for the weaknesses in the Levelised Cost of Electricity (LCOE)

In 2016, it must be noted that the prices paid for electricity by industry in Germany were 52% higher than in France (nuclear) and 86% higher than in Poland (coal). South Africa cannot allow this to happen. A research report by *D Weißbach et al.* (2013) on energy returned from energy invested (EROI) in Germany showed that renewables are uneconomic and will lead to economic stagnation (Raugei, M. et al. 2015). In contrast, the EROI of coal and nuclear are in territory that fosters growth. Currently, there are warnings that economic growth in Germany is slowing significantly.

Finally, the actual cost of wind and solar are not correctly depicted by LCOE. This methodology is criticised by several experts as set out previously (Mount *et al.*, 2012; Sklar-Chik, Brent and de Kock, 2016; Pentland, 2014; Greenstone *et al.*, 2019). There have been several attempts to overcome and reduce its weaknesses. A review of some of these methodologies has been set out in the paper by Graham, 2018, entitled "*Review of alternative methods for extending LCOE calculation to include Balancing Costs."* This report responded to a broad range of stakeholders requiring easily comparable cost data for electricity generation technologies. IEAEW See: Institute of Chartered Accountants in England and Wales. Institute of Chartered Accountants in England and Wales. (2017) *Debate: is renewable energy economically viable?* The primary concern is finding a solution to the inability of LCOE to capture the balancing costs that variable renewable electricity generation technologies invariably require to ensure the electricity system has a reliable and stable supply. (Graham, 2018). This methodology would make LCOE more valuable and practical for comparing technologies and measuring the least-cost solution for the best technology mix (Schernikau L, 2019; Schernikau L, Smith WH & Falcon R (2022) Smith, L. S. et al. (2017).

Importantly the Value Adjusted Levelised Cost of Electricity (VALCOE) was put forward by the International Energy Agency (IEA) 2018, World Energy. The VALCOE is an LCOE that

has been adjusted to account for the differences in Value each Technology provides to the electricity system. The VALCOE makes three adjustments to LCOE: Energy, Value and Flexibility. The model:2018 version, IEA OECD Paris, compensates for the known weaknesses of LCOE (NEA OECD (2018)).

Significantly although the IEA has made several adjustments to overcome the flaws in the Levelised Cost of Electricity (LCOE) .it apparently has not made an adjustment for the Cost of Unserved Energy (COUE) discussed earlier. These additional costs can be substantial depending on the region's variation in weather and climate and the political and trading conditions that may exist and change (Partridge, I. 2018). Renewables raise Eskom's costs. (Peacock B (2016).

It certainly is a fact that all major economies with fossil fuel reserves are substantially increasing their electricity supply from these resources, including India, China, the Asean countries, Japan and Poland (2016a) 'Coals Role in ASEAN energy; Suryadi (2016b; Follet, A. (2017)).

The chart below corrects for this risk

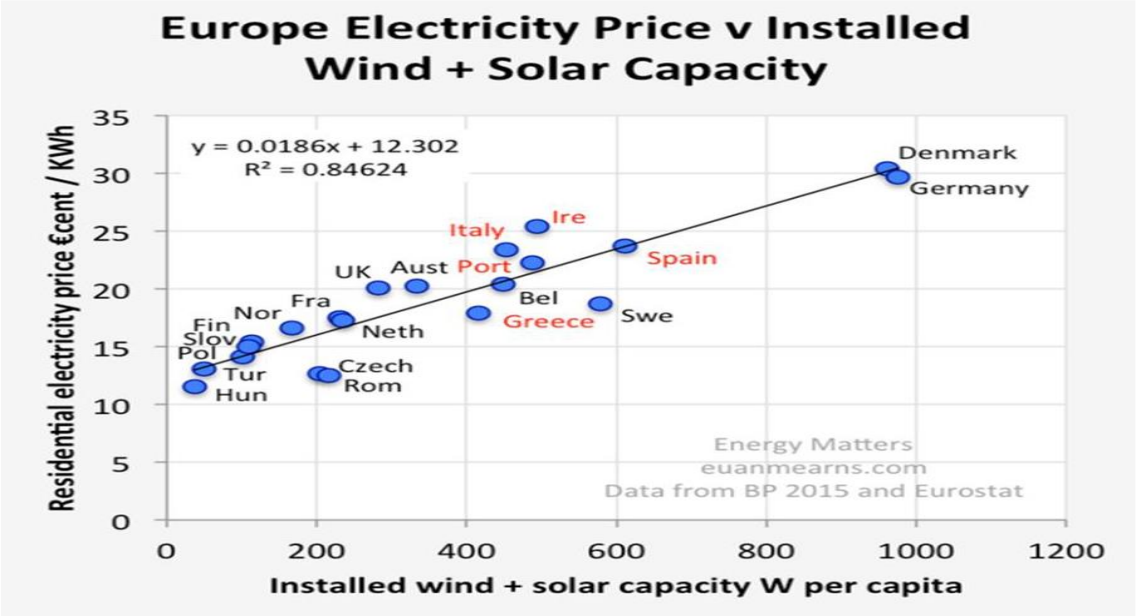
Source: R Jeffrey Economic Risk Consulting Jordaan J Economic Modelling

Risk related True economic LCOE by Technology

Potential Dispatchable Cost	Nuclear	New Coal	Wind	SolarPV
Apparent LCOE R/kWh	R1.30	R 1.05	R 0.62	R 0.62
Average capacity Load factor	90%	82%	35%	26%
Life in years	60 yrs	30 yrs	20 yrs	20 yrs
True Risk related LCOE based COUE at IRP rates R77.30/kWh	R1.33	R1.10	R2.02	R2.83
Total capital cost per delivered real kwh	R0.17	R0.19	R0.31	R0.31

Economic Risk Consultant

The chart below gives a real world comparison.



Source: Data from B.P. 2015 and Eurostat

26 Conclusion to Part 3

This last scenario is required if the country is to exit its unemployment and poverty trap. Unfortunately, this scenario appears unlikely, but it should not be.

India, China and the Asean countries are achieving this and are primarily basing their energy source growth on HELE' clean coal' and nuclear power stations (Harris, G 2016). They are set to double their coal-fired electricity generation over the next 30 years. South Africa could do it if the will and policy-makers worked with businesses to achieve it.

Despite wishful thinking, the only reasonable means of achieving security of dispatchable electricity supply at competitive prices in South Africa for future decades is via coal and Nuclear-generated power. A policy decision to embark on large-scale wind is not feasible in any event, as it requires the full backup of gas. At this stage, sufficient domestic gas deposits have not been found. Viable shale gas deposits have not been proven. Imported gas would create severe economic and balance of payments problems and be economically unaffordable.

Furthermore, the large-scale wind would lead to the destruction of the South African coal industry. The detrimental economic impact of this policy decision cannot be readily contemplated. These are two policy decisions which will be economically catastrophic for the country. The analysis recommended the energy source mix requirements for emerging and developing economies rich in fossil fuels.

This article's purpose is to clarify the country's stark choices. The mining and coal industries need to fight for their very future; otherwise, all is lost. All businesses need to look at the facts, as the current future policy plans for increasing wind and solar will detrimentally affect the entire economy for more than a generation. All methodologies confirm that renewables are significantly more costly and less efficient than coal or nuclear.

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27 Appendix

This is included as an important contribution to the energy discourse . The platform is member of TiE, and although promotes nuclear, is the part of the TiE ethos of the optimal energy mix to provide the most favourable solution for SA.

The South African Nuclear Build Platform's (SANBP) Response to IRP 2023

The SA Nuclear Build Platform is a forum which aligns the local industry to engineering, manufacturing, material supply and construction opportunities in the nuclear energy sector, providing sustainable, top-quality careers and jobs. It is also a member of the Truth in Energy group.

The IRP 2023 is complex and spans over an extended period of time. While we welcome long-term planning, the state of our energy system between 2030 and 2040 concerns us the most.

It is expected of an effective Integrated Resource Plan or Just Energy Transition (JET), to address the well-known Energy Trilemma, by providing Energy Security, Access to Affordable Energy and Environmental Sustainability, through deploying a balanced and sustainable energy portfolio. We can all agree that our JET, driven by previous biased IRPs, hasn't delivered any of these objectives, or even come close, over the last decade.

Our coal power boom that started in 1970 and continued for three decades at an expansion rate of about 1.25 GW per year or 8.5 TWh per year, drove unprecedented economic and industrial expansion in SA. With a life expectancy of 50 years, the retirement of these coal generating assets should start in the 2020s, with an already experienced economic slowdown.

Some have already been retired and the current low Energy Availability Factor (EAF) across the coal fleet, suggests we are heading for an even greater electricity crisis in the 2030s. We are currently generating the same amount of baseload electricity as we did 35 years ago. A viable, well-timed and planned nuclear newbuild procurement programme can provide some needed relief in the early 2030s.

The retirement of our coal fleet is only feasible if replaced with cleaner baseload power, like high-capacity natural gas, large hydro power, and nuclear energy, to optimise the supporting infrastructures on these sites and sustain the Grid. We can also retain, upskill, and realign the workforce that has been operating and maintaining these power plants with our safety culture.

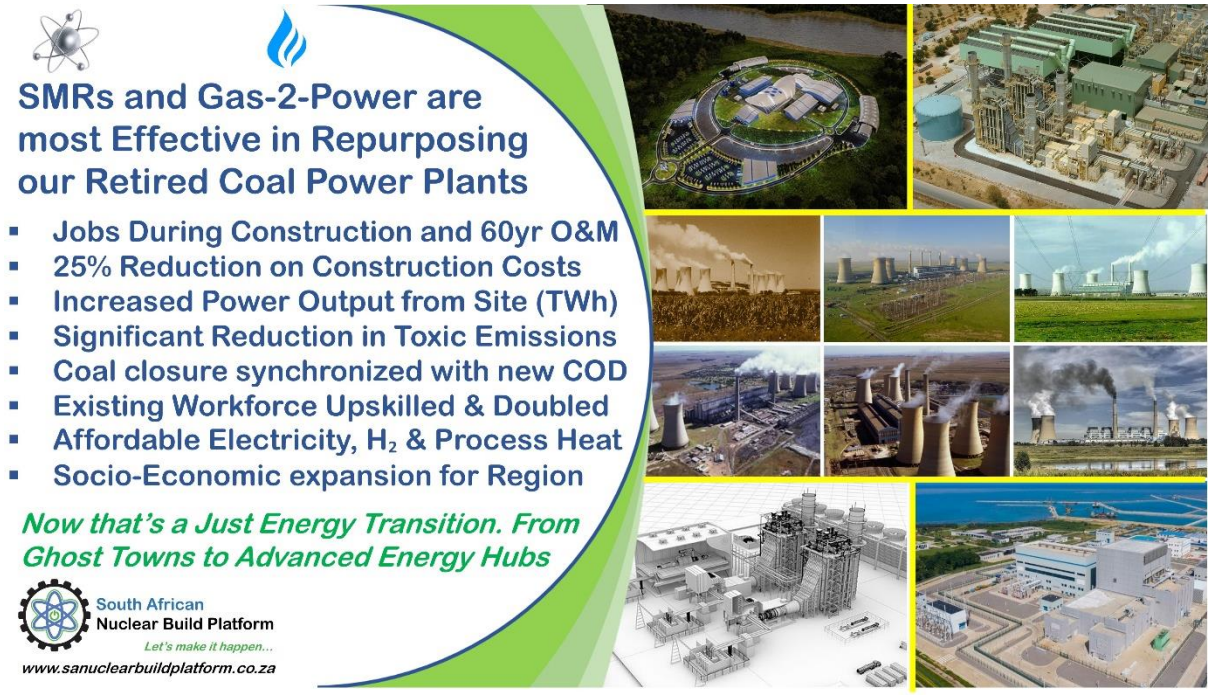
Although the IRP 2023 has emphasised energy security and the eventual retirement of our coal fleet, the high bias toward renewable energy suggests that our IRP planners haven't learnt the recent lessons from Germany. That an industrialised country like South Africa, needs a reliable baseload foundation to support weather-dependent generation technologies like wind and solar.

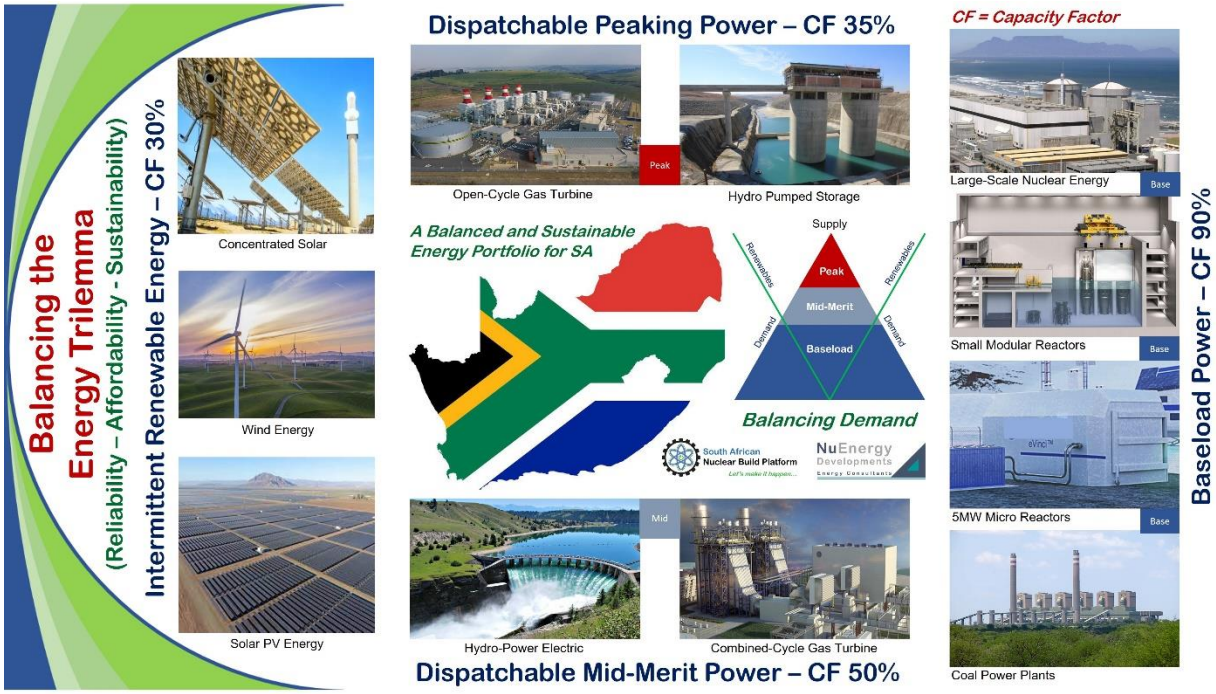
The IRP 2023 is not convincing that the pace and scale of adding new cleaner baseload power to the Grid, effectively balances the pace and scale of our coal retirement programme, with some expansion. Even the wind and solar plants built in the first few REIPPP Rounds will have to be replaced with new renewables in the 2030s.

We therefore need a more convincing IRP that clearly shows that we will achieve and maintain energy security in the 2030s, provide access to affordable electricity again, while delivering our sustainability objectives for 2050. Thereby recovering our struggling economy and currency and getting South Africa back to work.

Large-scale nuclear power plants, built on our shovel-ready coastal sites and SMRs used to repurpose our coal power stations is a reliable medium to long-term solution for load-shedding. Our Mines and Intensive Energy Users can also enjoy the benefits of nuclear energy and distributed SMRs. Nuclear energy is the only technology that meets all the

Energy Trilemma criteria and should therefore be considered for a more valuable contribution to this Integrated Resource Plan.





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* Extract from Dr Jeffrey's PhD (2023) energy thesis, *"Assessing the actual cost of alternative electricity generating technologies in South Africa in line with its economic development requirements".*

Freedom Foundation (Izwe Lami) is a newly established policy institute created by the old Free Market Foundation Founder and past President, Leon Louw, to continue and invigorate its work and values and his life-long commitment to economic and individual, and remain at the forefront of leading policy and economic ideas.

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Truth in Energy describes a group of energy experts with wide and diverse experience whose objective is to present optimum solutions to solve the energy crisis in South Africa. TiE is not driven by source ideology but by the efficient mix to deliver sustainable, cost effective and affordable electricity for all citizens.

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